W. H. HOLLOPETER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED APR. 26, 1909.

945,393.

Patented Jan. 4, 1910.

2 SHEETS—SHEET 1.

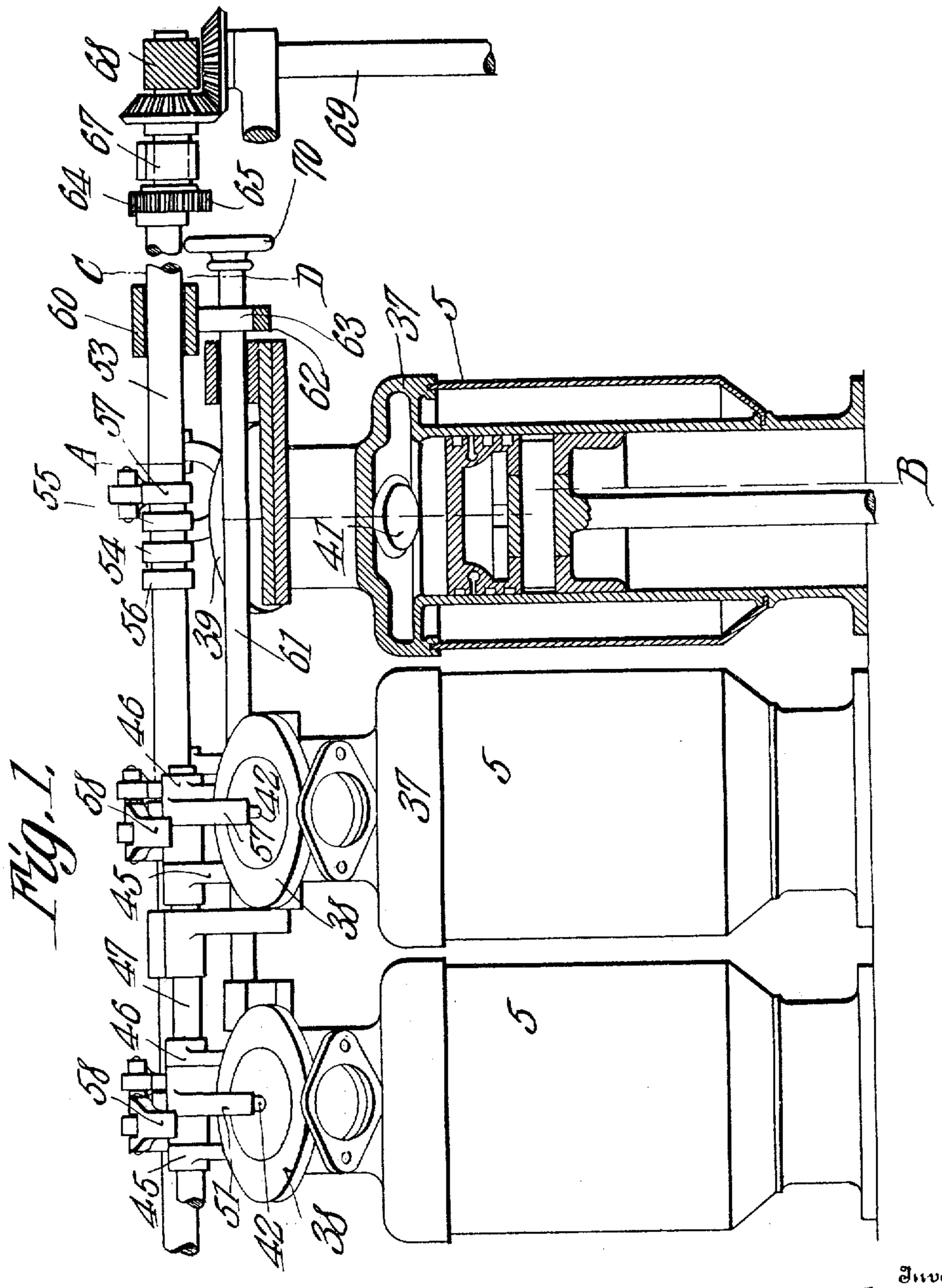

Fig. 1.

Witnesses

E. J. Stewart

F. T. Chapman

Inventor

William H. Hollopeter.

By Cachow & Co.

Attorneys

W. H. HOLLOPETER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED APR. 26, 1909.

945,393.

Patented Jan. 4, 1910.

2 SHEETS—SHEET 2.

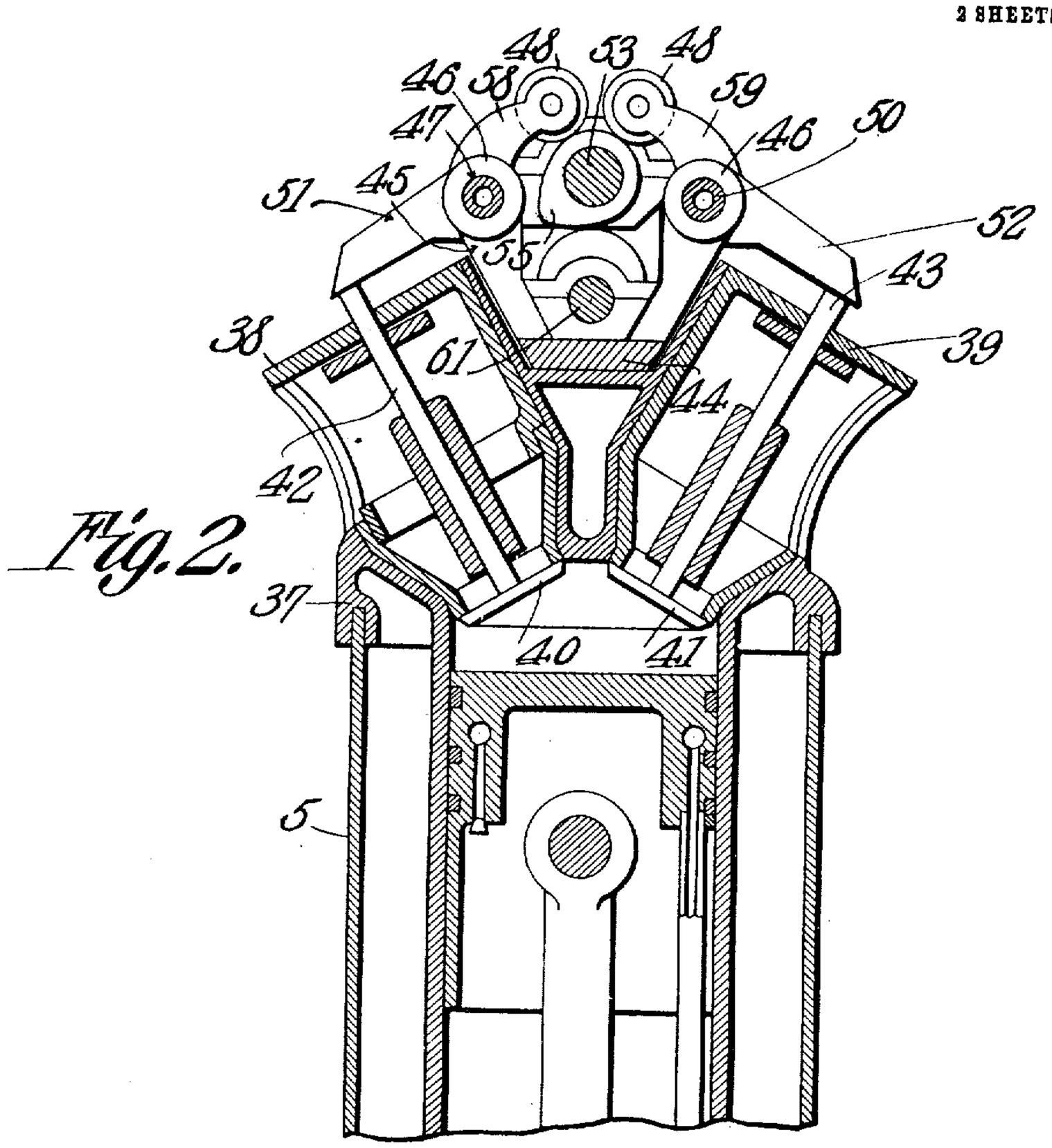

Fig. 2.

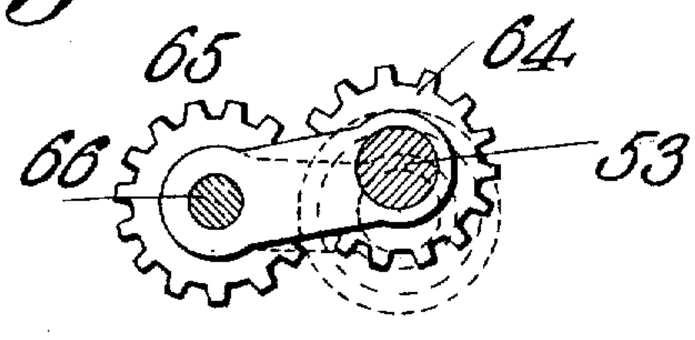

Fig. 3.

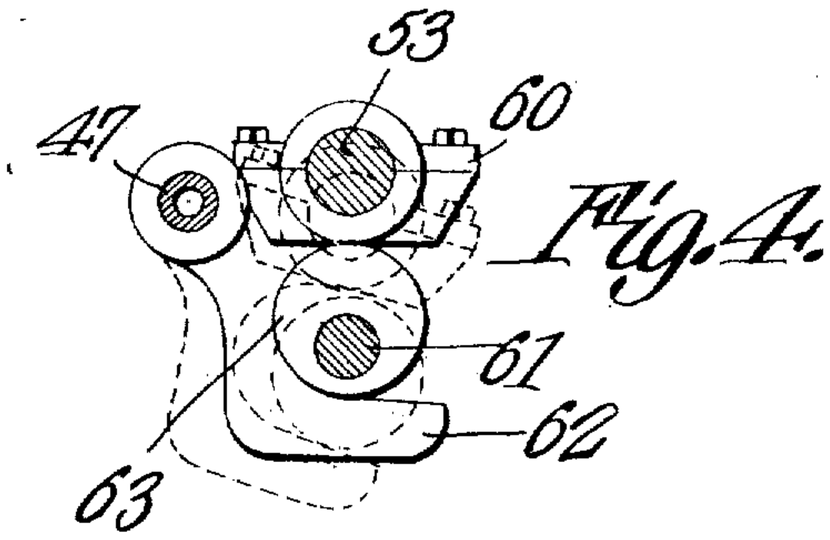

Fig. 4.

Witnesses

E. J. Stewart

F. J. Chapman

Inventor

William H. Hollopeter

By Church & Co.

Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM H. HOLLOPETER, OF PORTLAND, OREGON.

INTERNAL-COMBUSTION ENGINE.

945,393. Specification of Letters Patent. Patented Jan. 4, 1910.

Original application filed July 16, 1907, Serial No. 383,994. Divided and this application filed April 26, 1909. Serial No. 492,227.

To all whom it may concern:

Be it known that I, WILLIAM H. HOLLOPETER, a citizen of the United States, residing at Portland, in the county of Multnomah and State of Oregon, have invented a new and useful Internal-Combustion Engine, of which the following is a specification.

This invention has reference to improvements in internal combustion engines and is directed more particularly to the valve-controlling mechanism, the object of the invention being to provide a valve-operating mechanism which may be quickly changed so that the lead of the valves or their periods of opening will occur at a different time in the cycle and thus cause a reversal of the direction of rotation of the engine.

The present invention is adapted to either single or multi-cylinder engines and comprises a means for the reversing of the direction of rotation of the driving shaft through the linear movement of the valve cam shaft so as to disengage one set of cams operating the inlet and exhaust valves and bring into active position another set of cams on the shaft in such relation to the first mentioned set of cams that the valves are opened at a different period in the cycle.

The invention will be best understood from a consideration of the following detail description taken in connection with the accompanying drawings forming a part of this specification, in which drawings,

Fig. 1 is a side elevation with parts in section of a multi-cylinder engine equipped with the valve mechanism of the present invention. Fig. 2 is a section on the line A—B of Fig. 1. Fig. 3 is a detail view of a portion of the valve shaft gearing. Fig. 4 is a section on the line C—D of Fig. 1.

The present application is a division of another application for improvements in internal combustion engines filed by me on July 16, 1907 under the Serial No. 383,994.

Referring to the drawings, there are shown a number of cylinders 5 of a multi-cylinder engine of the four-cycle type but as the construction of the motive side of the engine does not enter into the present invention, therefore no description or showing thereof is deemed necessary, more especially as the valve mechanism forming the subject matter of the present invention is applicable to other types of engines than that shown in the aforesaid application.

Each cylinder 5 is provided with a head 37 on which are two valve chests or casings 38 and 39 inclined oppositely as shown, the valve chests having ports at their inner ends opening into the explosion chamber of the cylinder and there provided with outwardly closing valves 40 and 41 respectively. One of these valves constitutes the inlet valve for the explosive mixture and the other valve is the exhaust valve for the spent gases of combustion. The valves 40 and 41 are provided with valve stems 42 and 43 respectively extending axially through and beyond the valve chests and have the ends remote from the valves in position to be engaged by suitable operating mechanism to be described.

Secured to each cylinder head 37 between the valve chests is a bracket 44 provided with divergent upstanding arms 45 terminating in bearings 46, the bearings on one side supporting a horizontal tubular shaft 47 and the bearings on the other side supporting a similar horizontal tubular shaft 50. On the shafts 47 and 50 are journaled tappet arms 51 and on the shaft 50 are journaled tappet arms 52, the arms 51 engaging the valve stems 42 and the arms 52 engaging the valve stems 43. A shaft 53 extends from one end of the engine to the other midway between the shafts 47 and 50 and located slightly farther from the head of the engine than are the said shafts 47 and 50.

Secured to the shaft 53 at each cylinder are four cams 54, 55, 56 and 57. The cams 54 and 55 are designed to open the valves 40 and 41 when the engine is running in one direction, and when the cams 56 and 57 are brought into action then the engine will run in the reverse direction. The cams 54 and 56 act on the valve 40 through the intermediary of a curved finger 58 on the hub of the arm 51 which finger constantly bears on one or the other of the cams. A similar finger 59 projects from the hub of the tappet arm 52 and bears on either of the cams 55 or 57. Each curved finger 58 and 59 is provided with a roller contacting with the respective cam and thereby reducing the friction. The cam shaft 53 is journaled in swinging bearings 60 pivoted on the tubular shaft 47 and it may be swung in a direction away from the rollers 48 by means of a longitudinal shaft 61 parallel with the cam shaft and between it and the head of the cylinder. The shaft 61 is supported in bearings on the

brackets 44. Each swinging bearing 60 has one side a yoke or arm 62 embracing an eccentric 63 fast on the shaft 61 as best shown in Fig. 4. The number of bearings 60 and operating eccentrics 63 will depend upon the length of the cam shaft 53 and this length is determined by the number of cylinders 5 in the engine. One end of the cam shaft 53 is mounted in a pinion 64 in such manner as to be slidable longitudinally therethrough and this pinion 64 meshes with a like pinion 65 fixed on another shaft 66 in line with the hollow shaft 47. The shaft 66 is carried in bearings 67. The outer end of the shaft 66 is connected by miter gearing 68 to a shaft 69 which may receive motion from the main shaft of the engine at half the speed of the latter. At the end of the shaft 61 adjacent to the gearing 64, 65 it is provided with a hand wheel 70 by means of which an operator may rotate the shaft 61. Of course it will be understood that other means than a hand wheel may be employed for the same purpose.

When it is desirable to change the direction of rotation of the shaft 53 the eccentric shaft 61 is given a half turn by hand to change the position of the eccentrics 63, these eccentrics normally engaging the bearings 60 in a manner to hold the shaft 53 at the point of greatest distance from the head 37 of the engine cylinder. When the eccentrics are turned as described they cause a movement of the bearings 60, by engagement with the arm 62, so that the shaft 53 is moved toward the cylinder heads, thus bringing the cams on the shaft 53 to such a distance from the rollers on the arms 58 and 59 that the cam shaft may now be moved in the direction of its longitudinal axis through its bearings to bring the heretofore inoperative set of cams into position to operate the curved arms 58 and 59 as soon as the cam shaft 53 is returned to its original position by means of the reverse or further turning of the eccentric shaft 61. Under these conditions the valve mechanism is in position to cause the engine to run in the reverse direction. The axis of the pinion 65 is coincident with the axis about which the cam shaft bearings 60 swing so that the movement of the cam shaft toward and from the cylinder heads does not disturb the relation between the pinions 64 and 65.

It will be understood of course, that the reversing mechanism is not confined to the particular valve structure shown and that the structure may be modified to adapt the invention to other types of valves.

What is claimed is:—

1. In an internal combustion engine provided with inlet and exhaust valves, a means for operating said valves comprising rock arms for moving the valves to the open position, a cam shaft for operating the rock arms and capable of longitudinal movement, and bearings for said shaft movable about an axis parallel and displaced with reference to the longitudinal axis of the shaft.

2. In an internal combustion engine provided with inlet and exhaust valves, rock arms for opening said valves, a longitudinally movable cam shaft having two sets of cams for the valves, and bearings for said shaft through which the latter is movable, said bearings being movable about an axis parallel but displaced with reference to the longitudinal axis of the shaft.

3. In an internal combustion engine provided with inlet and exhaust valves, rock arms for opening said valves, a longitudinally movable shaft having two sets of cams thereon for actuating the rock arms, bearings for the cam shaft through which the latter is movable longitudinally and which in turn are movable about an axis parallel but displaced with relation to the longitudinal axis of the cam shaft, and another shaft rotatable about its longitudinal axis and provided with cams or eccentrics engaging the bearings of the cam shaft.

4. In an internal combustion engine provided with inlet and exhaust valves, rock arms for moving the valves to open position, a shaft carrying two sets of cams and movable longitudinally to bring either set of cams into active relation to the rock arms. another shaft parallel with but displaced with relation to the cam shaft, cams on the second shaft, and bearings for the cam shaft having an axis about which they are movably displaced with relation to the cam shaft and said bearings each being provided with an arm engageable by the respective cam or eccentric on the second shaft.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

WILLIAM H. HOLLOPETER.

Witnesses:
W. A. KING,
J. G. BENNETT.